



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/535,310	05/18/2005	Kenichi Fukuoka	28955.1049	3702
27890 7590 06/05/2008 STEPTOE & JOHNSON LLP 1330 CONNECTICUT AVENUE, N.W. WASHINGTON, DC 20036			EXAMINER NELSON, MICHAEL E	
			ART UNIT 1794	PAPER NUMBER
			MAIL DATE 06/05/2008	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/535,310

**Applicant(s)**

FUKUOKA ET AL.

**Examiner**

MICHAEL E. NELSON

**Art Unit**

1794

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 May 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SI/02)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_
- Paper No(s)/Mail Date 05/18/2005

## **DETAILED ACTION**

### ***Drawings***

Figure 3-5 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-14 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for some materials, does not reasonably provide enablement for the full scope of the claims. The specification does not enable any person skilled in the art to which it pertains, or with which it is most

nearly connected, to make the invention commensurate in scope with these claims.

Case law holds that applicant's specification must be "commensurately enabling [regarding the scope of the claims]" *Ex Parte Kung*, 17 USPQ2d 1545, 1547 (Bd. Pat. App. Inter. 1990). Otherwise **undue experimentation** would be involved in determining how to practice and use applicant's invention. The test for undue experimentation as to whether or not all compounds within the scope of claims 1-14 can be used as claimed and whether claims 1-14 meet the test is stated in *Ex parte Forman*, 230 USPQ 546, 547 (Bd. Pat. App. Inter. 1986) and *In re Wands*, 8 USPQ2d 1400, 1404 (Fed.Cir. 1988). Upon applying this test to claims 1-14, it is believed that undue experimentation **would** be required because:

(a) *The quantity of experimentation necessary* is **great** since claims 1-14 read on the entirety of chemical space while the specification discloses a small number of structural classes which **may** meet the requirements of the claims.

(b) There is **no direction or guidance presented** for predicting or selecting materials beyond the structural classes discussed in the claims.

(c) There is an **absence of working examples** since the examples provide examples of only two materials which have very similar structural features.

In light of the above factors, it is seen that undue experimentation would be necessary to make and use the invention of claims 1-14 within the scope of the claims.

2. Claim 1 requires two light emitting layers, where the first and second light emitting layer both have a host and a dopant material, where in each layer the energy gap of the host is greater than the energy gap of the dopant, and where the dopant in the first layer has an energy gap greater than the energy gap of the dopant in the second layer. Additionally, the claim requires that the intensity at the maximum luminescent wavelength derived from the first dopant be 3.5 times the luminescent intensity of derived from the second dopant.
3. Claim 4 requires the same limitations as claim 1, with the exception that both dopant materials have an energy gap greater than 2.7 eV, and that the relative luminescent intensity is not required.
4. While the measurement of energy gaps is routine in the art, in order to practice the full scope of the claims, **all** compounds must be individually measured and then compared to determine if they meet the requirements of the first claim. A full UV spectrum must be collected for each dopant, and a device prepared using the hosts and dopants selected. Then the relative emission must be determined based on the emission of the two dopants to determine if the device has the correct intensity relationship. While the manipulations are, on the whole, routine to one of ordinary skill, the enormity of scope requires that countless measurement must be taken and devices prepared in order to practice the scope of the claims as written.
5. Given the lack of examples, and the fact that many materials, with many different functions can meet the requirements of claims 1 and 4. Compounds which have distinctly different charge transporting properties, while they meet the

Art Unit: 1794

general requirements of claims 1 and 4, may not even produce a functioning device.

6. For that reason, given the extreme scope of claims 1 and 4, one of ordinary skill in the art would not be able to practice the invention commensurate with the scope of the claims, because of the undue level of experimentation required.

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

9. Claim 11 states that the luminescent intensity at the maximum luminescent wavelength of an emission spectrum derived from the **second emitting layer** is 0. It is unclear how a layer where the luminescent intensity is zero can be considered an emitting layer. For the purposes of examination, the second emitting layer will be interpreted to be a structural, rather than a functional requirement. As such, non-emitting layers, adjacent to emitting layers, would be considered a second emitting layer regardless of their respective function, provided the materials have the \*potential\* to be light emitting.

***Claim Rejections - 35 USC § 102***

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claims 1, 5-7, 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Hatwar (EP 1187235).

12. Concerning claim 1, Hatwar describes an organic electroluminescent element comprising an anode, a first emitting layer with a host and a first dopant, and a second emitting layer with a second host and second dopant, and a cathode. The first light emitting layer is 20 nm thick (per claim 10) comprises a host material of ADN (9,10-dinaphthylanthracene), doped with 1.5 % (per claim 5) of TBP (tetrabutylperylene). The second light emitting layer comprises a host of Alq with 0.3% rubrene (per claim 6). It is standard in the art to dope materials with smaller energy gaps into hosts with larger energy gaps, and in this case the hosts and dopant materials are all well known, and the host materials have greater energy gaps than their respective dopants. The percentages are by weight, but with roughly equivalent molecular weights and densities, correspond to roughly the same values by mole. The host of the first material is identical to the material of claim 7, where Ar<sup>1</sup> is anthracene, X is 2-naphthyl, and m is 1, and n is 2. (See Example N, Table 3, page 14, and [0053]-[0054], page 13. The

relative luminance for the two components is shown in Fig. 8 (page 30). An inspection of the curve for device N shows that the maximum for the blue emission (around 450nm) is above 0.035, while the maximum luminescence for the yellow peak (around 550nm) is slightly above 0.01. Since at least a portion of the luminescence at the 550nm peak is derived from the first material (as shown in device M), the actual emission from the second component is impossible to determine accurately, but it would be reasonable to say that the intensity due to the first dopant was at least 3.5 times the intensity of the second dopant.

***Claim Rejections - 35 USC § 103***

13. Claims 1-2, 5-7, and 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hosokawa et al. (JP 2000-068057) with evidence of inherency supplied by Hosokawa et al. (5,536,949).

14. Concerning claim 1-2, Hosokawa et al. describe an organic electroluminescent device comprising an anode (71) and a cathode (72) and a first luminescent layer (83) and a second luminescent layer (84) (Figure 4). The host material for the first layer is DPVDPAN, and the host material for the second light emitting layer is DPVDPTHpy. The dopant in the first layer is DPAVBi, and the dopant for the second layer is coumarin 6. (See example 2, [0132]).

Hosokawa et al. states that it is important that the energy gap of the dopants are less than the energy gap of the host materials, [0097] so it is reasonable to predict that the energy gaps of the host materials described by Hosokawa et al. are greater than the energy gaps of the dopants, and therefore the energy gap

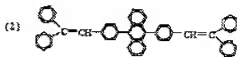
Art Unit: 1794

relationships are met inherently. Hosokawa et al. are silent on a relative luminescent intensity of the first material should be 3.5 or 5 times the luminescent intensity of the second material. However, Hosokawa et al. also state that the color tone of the luminescent color can be set at a desired color tone by adjusting the thickness of the second luminous layer, or adjusting amount of the addition of the fluorescent substance. [0102] Given this teaching, it would have been obvious to one of ordinary skill in the art to adjust the relative intensity of the two layers, where the emission from the first dopant material is 3.5 or 5 times (per claims 1 and 2) the emission intensity of the second material for the purpose of adjusting the color tone of the emission.

15. Concerning claims 5-6, Hosokawa et al. teach that the weight ratio of the host to the dopant in both light emitting layers should be between 100:1 (slightly less than 1%) to 10:1 (slightly less than 10%) by weight. [0103] Assuming roughly equivalent molecular weights and densities, they would correspond to approximately the same percentage by mole. Regardless, given the teaching as discussed above, it would have been obvious to one of ordinary skill to adjust the relative concentrations of the two dopants to adjust the relative intensity of the two layers to create the desired color tone.

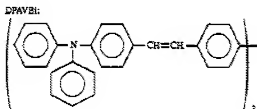
16. Concerning claim 7, Hosokawa et al. state that the host material for the first layer is DPVDPAN, which has the structure shown below, which meets the requirements of claim 7 where Ar<sup>1</sup> is anthracene, and X is a substituent, m is one, and n is 2.

Art Unit: 1794



17. Concerning claim 10, Hosokawa et al. disclose in Example 2 that the thickness of the first light emitting layer is 20nm. (see [0132] which refers back to [0127]) Hosokawa et al. further discloses that the thin film thickness should, in general, be between 5nm and 5 $\mu$ m in thickness [0120].

18. Concerning claim 9, Hosokawa et al. describe the organic electroluminescent device discussed above, where the first dopant is DPAVB<sub>i</sub>. Hosokawa et al. do not disclose the structure of DPAVB<sub>i</sub>, but the compound is a well known blue light emitting material, and is described by Hosokawa et al. ('949), and is shown below. (column 53) This compound meets the requirements of claim 9 where Ar<sup>2</sup> is a substituted styryl group, Ar<sup>3</sup> and Ar<sup>4</sup> are both phenyl, and p is 2.



19. Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakai et al. (6,224,966).

20. Concerning claim 1, Sakai et al. describe an organic electroluminescent device comprising an anode and a cathode and at least two light emitting layers

between the anode and cathode, where each light emitting layer is doped with a fluorescent substance, and where the fluorescent substance is of the same type or color in both layers (abstract).

21. Sakai et al. define the same 'type' to be compounds having the same backbone skeleton, while the same 'color' means compounds which are classified only into one of three primary colors (blue, yellow or red). (column 42, lines 1-7).

22. Given this teaching, it is clear that Sakai et al. envisage the use of different compounds in the two layers, so long as they have the same backbone skeleton or same color. Sakai et al. further state that it is indispensable that the energy gap of the fluorescent substance (dopant) is smaller than that of the host substance to ensure efficient energy transfer from the excited state of the organic host to the excited state of the dopant (column 41, lines 30-36). Sakai et al. state that the use of two light emitting layers having the same color results in an increase in efficiency and lifetime of the device (column 41, lines 18-21). Sakai et al. are silent on the use of a compound with a dopant with a higher energy gap in the first layer with a compound with a lower energy gap in the second layer. Since any two non identical materials would have different energy gaps, and given the teaching of the use of different materials, so long as they have the same core structure or color of emission, it would have been obvious to one of ordinary skill in the art to use a material with a larger energy gap in the first layer, and a smaller energy gap in the second layer, so long as the two compounds had either the same core structure or same color of emission, and to predict that such

an arrangement would give the same benefit as described by Sakai et al. Since this structure possesses the same features as the structures described in the specification, the relative ratio of luminescence intensity from the first layer and the second layer are met, and can be easily adjusted by changing the thickness of the layers or doping concentrations to achieve a relative luminescent intensity from the first layer than is 3.5 or 5 times the luminescent intensity from the second layer. (per claims 1 and 2)

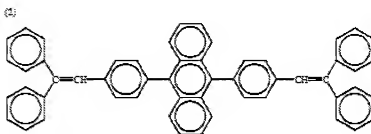
23. Concerning claims 3 and 4, Sakai et al. describe preferred materials for the host and the dopants, and state that preferred fluorescent materials (dopants) are distyrylarylene derivatives, such as diphenylaminovinylarylenes (column 41, lines 39-41), which are well known blue emitting materials. For the purpose of producing blue emission, it would have been obvious to one of ordinary skill in the art to select materials having an energy gap greater than 2.7 eV.

24. Concerning claims 5 and 6, Sakai et al. disclose that the ratio of the host to the dopant in each light emitting layer may be freely determined in consideration of the light-emitting efficiency and lifetime of the device, but preferably are within the range of 100:1 (slightly less than 1%) and 10:1 (slightly less than 10%) by weight (column 41, lines 46-52). Assuming roughly equivalent molecular weights and densities, would correspond to roughly similar ranges by mole, but would have been well within the level of ordinary skill to adjust the concentrations as needed.

25. Concerning claim 7, Sakai et al. state that the host materials is not specifically defined, and may be of any and every compound of which the

Art Unit: 1794

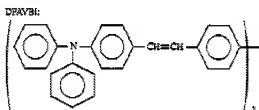
function is to inject holes and electrons into the layer and transport them through the layer to be recombined to give fluorescence. (column 3, lines 54-61) Sakai et al. do give preference to styrylarylene derivatives, however, and teach by example compounds such as DPVDPAN, shown below (see examples, columns 48-50). This material meets the requirements of claim 7, where Ar<sup>1</sup> is anthracene, and X is a substituent, m is 1, and n is 2.



26. Concerning claim 8, Sakai et al. state that the host materials is not specifically defined, and may be of any and every compound of which the function is to inject holes and electrons into the layer and transport them through the layer to be recombined to give fluorescence. (column 3, lines 54-61) Sakai et al. give preference to materials which have an electron affinity of not less than 2.6 eV, more preferably between 2.6 and 3.2 eV (column 3, lines 61-63). Sakai et al. do not require that the host materials in the two layers be different, though they do prefer a particular energy relationship between the two host materials. It would therefore have been obvious to one of ordinary skill in the art to use the same host material in both layers, provided that the energy gap of the host material was greater than the energy gap of the dopant materials, as discussed above.

Art Unit: 1794

27. Concerning claim 9, Sakai et al. state that the fluorescent substance (dopant) is not defined and may be of any known fluorescent dye capable of emitting light in response to the recombination of holes and electrons, with the requirement that the energy gap of the fluorescent substance is smaller than the energy gap of the host material in each layer. (column 41, lines 27-36) Sakai et al. state a preference for styrylarylene materials, and in particular diphenylaminostyrylarylenes. (column 41, lines 39-41) By example, Sakai et al. teach the use of DPAVB as the dopant material, shown below for illustration, which meets the requirements of claim 9 where  $Ar^3$  and  $Ar^4$  are both phenyl, and  $Ar^2$  is a aryl styryl group, and p is 2.

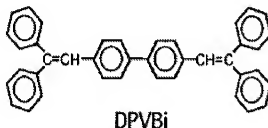


28. Concerning claim 10, Sakai et al. disclose that the thickness of the thin films for the device should be between 5nm and 5  $\mu$ m (column 47, lines 63-64), and teach by example, devices where the first light emitting layer is 20nm.

29. Claims 1-7, 10-11 rejected under 35 U.S.C. 103(a) as being unpatentable over Hosokawa et al. (Applied Physics Letters, vol. 67, no. 26, pp. 3853-3855, December 1995) in view of Wakimoto et al. (US 2001/0052751) with evidence supplied by Suzuki et al. (6,750,472).

Art Unit: 1794

30. Concerning claim 1, Hosokawa et al. describe organic electroluminescent devices comprising an anode, and a cathode, and a light emitting layer comprising a host material (DPVBi) (energy gap 3.1 eV, see Fig 1)) and a dopant material (BCzVB) (energy gap 2.97 eV (see page 3854, column 2)), followed by an electron transport layer. (Fig. 1)



31. Concerning claim 5, Hosokawa et al. disclose that the concentration of the dopant in the light emitting layer is 3-4% by mol (see page 3853, column 2).

32. Concerning claim 7, the host material described by Hosokawa et al. meets the requirements of claim 7 where Ar<sup>1</sup> is phenyl, and x is a substituent, and m and n are both 2.

33. Concerning claim 10, Hosokawa et al. disclose that the light emitting layer is 40nm thick. (see page 3853, column 1)

34. Hosokawa et al. are silent on a second layer comprising a host and dopant in the device.

35. Wakimoto et al. describe organic electroluminescent devices comprising a hole blocking layer between the light emitting layer and an electron transport layer, where the hole blocking layer comprises a mixture of electron transport materials. Wakimoto et al. state that the purpose of the hole blocking layer

Art Unit: 1794

serves to limit the migration of holes from the organic light emitting layer, resulting in improved recombination probability and a higher light emission efficiency. [0007] The use of a mixture of materials in the hole blocking layer provides an improved stability in comparison with devices having a hole blocking layer with a single component. [0040] Wakimoto et al. disclose the preference for the use of BCP and BAQ in the hole blocking layer. Wakimoto et al. do not disclose the energy gap of the materials, the energy gap is an inherent feature of the materials themselves. BCP is a well-known high energy gap material, and functions as the 'host' of the layer. BAQ is a known material, and the energy gap can be calculated from the difference in the conduction band (3.0 eV) and valence band (5.8 eV) for the material, as reported by Suzuki et al., resulting in an energy gap of 2.8 eV (column 14, lines 33-36). This value is less than the dopant of the light emitting layer, (per claim 1), and greater than 2.7 (per claim 4).

36. Concerning claim 1-2 and 11, give, this teaching, it would have been obvious to one of ordinary skill in the art to use the hole blocking layer described by Wakimoto et al. for the purpose of improving the recombination probability in the light emitting layer to improve light emission efficiency, and to improve the stability by using a mixed layer. Furthermore, functioning as a hole blocking layer, holes are prevented from traveling into the hole blocking layer, resulting in zero emission from the hole blocking layer (per claims 1, 2 and 11).

37. Concerning claim 6, Wakimoto et al. disclose that the concentration of electron transporting materials in the layer are preferably between 5 and 95% by weight, which would correspond to roughly the same range by mole, assuming

roughly equivalent molecular weights and densities. Regardless, it would have been obvious to one of ordinary skill to adjust the concentration of the second material as needed to optimize the performance of the device.

38. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hosokawa et al. (Applied Physics Letters, vol. 67, no. 26, pp. 3853-3855, December 1995) and Wakimoto et al. (US 2001/0052751) with evidence supplied by Suzuki et al. (6,750,472) as applied to claim 1 above, and further in view of Wakimoto et al. (US 2001/0043044), hereinafter referred to as ('044).

39. Concerning claim 8, Hosokawa et al. describes the organic electroluminescent device discussed above, while Wakimoto et al. describes the use of a hole blocking layer to improve the emission efficiency, formed of a mixture of materials to improve the stability of the device. They are silent on using the same host material in the second layer as the first layer.

40. Wakimoto et al. ('044) describes organic electroluminescent devices comprising a mixed layer between a light emitting layer and a hole blocking layer comprising a mixture of a material from the light emitting layer, and the material of the hole blocking layer. Wakimoto et al. ('044) further describes the mixed layer where the electron transporting materials of the mixed layer are themselves a mixture of two materials. Wakimoto et al. discloses that including a layer comprising material from the light emitting layer and the hole blocking layer, between the light emitting layer and hole blocking layer results in an improvement in device lifetime [0042], which preventing mutual diffusion of the

hole blocking layer and adjacent layers due to heat generated during the driving of the electroluminescent device.

41. Given this teaching, it would have been obvious to one of ordinary skill to include the material from the light emitting layer (the host material) in the adjacent layer along with the hole blocking materials described by Wakimoto et al. for the purpose of improving the lifetime of the device and preventing mutual diffusion of the hole blocking layer and adjacent layers due to heat generated during the driving of the electroluminescent device.

42. Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hosokawa et al. (JP 2000-068057) as applied to claim 1 above, and further in view of Mishima et al. (2002/0096995).

43. Concerning claims 12-14, Hosokawa et al. describe the organic electroluminescent device discussed above, and further describe the use of an electron injecting layer between the light emitting layers and the cathode [0104], which has the function to transmit an electron from the cathode to the luminous layer, specifically 8-hydroxyquinoline metal complexes, and oxadiazoles. [0115]. Hosokawa et al. are silent on the use of material having a specific electron mobility, or with a specific structure as the electron transporting material.

44. Mishima et al. describe electron transporting materials, and state that in view of the driving voltage the electron mobility of the electron transporting material should be preferably  $1 \times 10^{-4} \text{ cm}^2/\text{Vs}$  or more, and that such materials are capable of well adjusting the charge balance of holes and electrons in the light

Art Unit: 1794

emitting layer, proving a high luminance and high light emitting efficiency. [0066]

Preferred compounds are compounds having two or more atoms other than carbon atoms and hydrogen atoms (heterocyclic derivatives), preferably including compounds having an imidazole, or imidazopyrazine structure [0068].

45. Given this teaching, it would have been obvious to one of ordinary skill in the art to use compounds described by Mishima et al. in the electron transporting (electron injecting) layer of the device described by Hosokawa et al. for the purpose of adjusting the charge balance of holes and electrons in the light emitting layer, and providing a high luminance and high light emitting efficiency.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL E. NELSON whose telephone number is (571)270-3453. The examiner can normally be reached on M-F 7:30am-5:00pm EST (First Friday Off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Callie Shosho can be reached on 571-272-1123. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1794

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Michael E. Nelson  
Examiner  
Art Unit 1794

/Callie E. Shosho/

Supervisory Patent Examiner, Art Unit 1794